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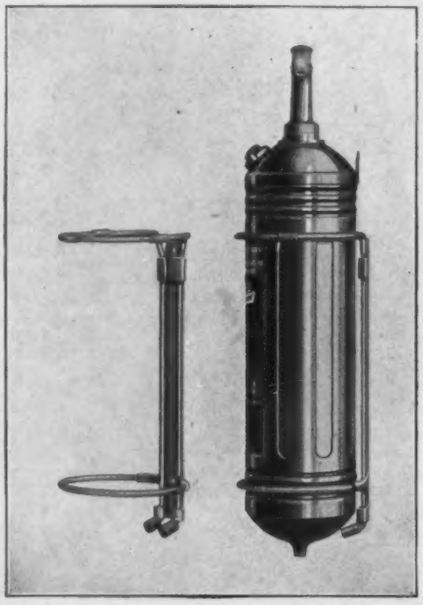

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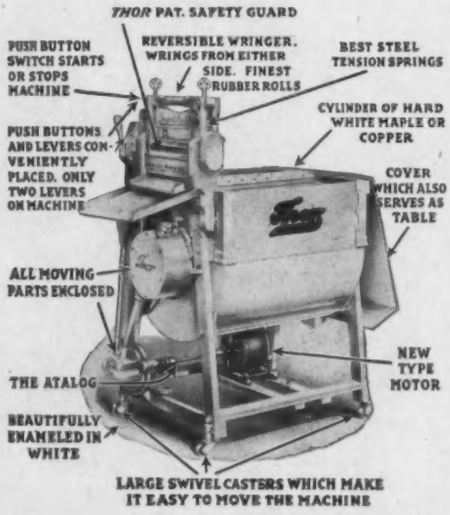
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(The paper on "Laying Power Cable Across San Francisco Bay," by J. A. Koontz and L. P. Cornell, as scheduled for this space, has been held up at the last moment, at the request of the executive committee of the local section of the American Institute of Electrical Engineers. The meeting devoted to this subject has been postponed from April 28th to May 26th, because of a special joint meeting of all San Francisco engineers on May 2nd regarding the subject of military engineering preparedness. The concluding portion of the series of articles on electro-metallurgy is consequently given this position.—The Editor.)

FEASIBILITY OF WESTERN ELECTRO-METALLURGY

BY DORSEY A. LYON AND ROBERT M. KEENEY.

Pig iron. In electric furnace smelting of iron ores electric energy is used to supply the heat necessary for reduction instead of charcoal or coke as in the blast furnace; and as only one-third or less of the charcoal or coke that is used in blast furnace work is needed in the electric furnace for the reduction of iron oxides, it is possible to produce in the electric furnace three times as much iron with one ton of charcoal or coke as in the blast furnace.

Raw materials and labor. The raw materials necessary for the manufacture of pig iron in the electric furnace are iron ore, either hematite or magnetite, limestone and charcoal or coke. There is no choice as to the kind of iron ore, as the electric furnace will handle either hematite or magnetite. In regard to the limestone it is sometimes considered advisable to calcine the limestone before use in the electric furnace, to reduce the consumption of power which would be caused by the heat necessary to remove the carbon dioxide from the limestone in calcinaion, but the use of calcined limestone is not advisable because of the fine material added to the charge in this way. Charcoal is preferable to coke in electric furnace manufacture of pig iron, because the energy consumption is less due to the possibility of use of the shaft type of furnace with charcoal, and operation of the furnace is more steady. Coke can be used, however, in the rectangular type of furnace without a high shaft.

Chinese iron ore appears to be the most available source of ore supply. There is plenty of iron ore of good grade in Southern California, but the freight rate on it would prohibit its use, as it would be necessary to haul it several hundreds of miles by railroad before a water haul could be made. It is estimated that Chinese iron ore containing 60 per cent iron could be laid down at The Dalles at a cost of $5 per ton. The iron ore necessary per ton of pig iron produced amounts to 16 tons, costing $8.

From information at hand, it seems that the most available source of limestone is on Puget Sound. This could be laid down at The Dalles for about $1.75 per ton. For the manufacture of pig iron in the shaft type of furnace this would not be calcined, as there would be too much dust formed, which causes hanging of

An Undeveloped Power Site in Oregon.

the charge in the furnace. About one quarter of a ton of limestone costing $0.44 is required per ton of pig iron produced.

Charcoal or coke could be used as a reducing material. At the starting of a plant, charcoal would be the preferable material, but if the plant assumed great proportions, say requiring much over 100 tons of charcoal per day, we believe that it would be necessary to use coke, on account of possible scarcity of charcoal. It is estimated that charcoal could be laid down at The Dalles for about $9 per short ton and coke for $8 to $11 per long ton, so that we will assume the cost of reducing agent as $10 per long ton. About one-third of a ton of reducing agent would be necessary per ton of pig iron produced, which would cost $3.33.

Labor requirements are the same as in blast furnace manufacture of pig iron, and a minimum wage of $2.50 per day of eight hours is assumed.

Power. The power requirements are practically the same as in the manufacture of ferrosilicon. Power will be considered as costing at the furnaces $11.70 per horsepower year, or 0.18 cents per kilowatt hour.

Cost of production. The estimate is based upon an annual production of 50,000 tons of pig iron. The plant would consist of five electric furnaces of 3500 horsepower each, the whole plant requiring 18,000 horsepower, including 500 horsepower for various uses outside of the furnaces.

Cost of Production of Pig Iron in the Electric Furnace at The Dalles, per long ton.

1.6 tons of iron ore at $5 per long ton	$ 8.00
0.33 long tons of charcoal or coke at $10	3.33
0.25 long tons of limestone at $1.75	0.44
10 lb. of carbon electrodes at 5 cents	0.50
2400 kw.-hr. at 0.18 cents	4.32
Labor	5.00
Maintenance and repairs	0.50
Amortization, depreciation at 5 per cent each	1.70
Interest at 6 per cent	1.02
General	1.40
Total	$26.21

The cost of production of pig iron at The Dalles by use of the electric furnace would be about $26 per long ton. As the market for this pig iron would be entirely upon the Pacific Coast, it could be sold f.o.b. plant. Laid down in Seattle or Portland or San Francisco, this pig iron would cost respectively, $28, $26.50 and $30.50.

Market. The market for pig iron manufactured at The Dalles would be entirely upon the Pacific Coast and Canada. At the present time we do not believe that this market would be very great, due to the fact that with pig iron selling on the coast at from $20 to $25 per ton there is little incentive to use it in foundry work when scrap iron can be purchased at a much lower price. There is no large steel plant on the coast which would be a consumer of pig iron. Of course, with a production cost f.o.b. Dalles of $26 per long ton, very little profit, if any, could be made on pig iron produced there, as the price ranges more around $21 per ton f.o.b. San Francisco than it does around $25.

Another important factor lies in the cheapness with which pig iron from England, China and India can be laid down upon the Pacific Coast. Pig iron from any of these countries could be delivered at Portland for from $18 to $20 per long ton. With the Panama Canal open it is now possible to lay Eastern pig iron down on the Pacific Coast for about $18 per long ton, so that the foreign or Eastern producer could undersell The Dalles manufacturer considerably.

Conclusions. The electric furnace manufacture of pig iron at The Dalles does not appear to be a feasible enterprise commercially, because of the high cost of product and market conditions. It would not be feasible commercially, either for sale of the pig iron as such or manufacture into steel at the plant because Eastern billet steel can be brought to the Pacific Coast at a total cost of $30.50 per long ton, which would be much less than possible production at The Dalles.

The high cost of production is largely caused by the high cost of iron ore, which is about double that paid by Eastern blast furnaces which are producing pig iron for about $10 per long ton; and also by the high labor cost which is about 70 per cent more expensive than Eastern labor. The cost of reducing material is also high as compared with the cost of Eastern coke at the furnaces, in spite of the fact that the electric furnace uses one-third of the amount of coke used by the blast furnace. It may be stated that the cost of production alone would be prohibitive of the success of an electric furnace pig iron industry at The Dalles.

To assure commercial success the plant should be able to sell its product in the coast market at as low a figure as $18 per ton if necessary. Eastern or foreign pig iron can be laid down at that cost. Also, we do not believe the market for pig iron with the price as high as $20 per ton will grow very rapidly, as it is cheaper to use scrap iron to make castings. For these reasons we do not feel that an enterprise manufacturing pig iron in the electric furnace at The Dalles would be financially successful.

Steel. There are two courses of procedure for steel manufacture in which the electric furnace has been used—cold scrap iron and steel of either inferior or high grade quality is melted and refined in an electric furnace with the production of steel of the highest grade equal to the best crucible steel; and molten steel, the product of either the acid or basic converters, or of the acid or basic open-hearth furnaces, is superrefined, or made into alloy steel, in an electric furnace. The steels thus made may be cast into ingots or various shapes. It has been proposed to use the electric furnace for the manufacture of steel from molten pig iron, but for use at The Dalles the cost would be prohibitive. The cost of any process using pig iron as a starting point at this place would be prohibitive, due to the high cost of pig iron, $26 if made at the plant and at least $20 if purchased from the East or foreign countries. Eastern steel at $30.50 would control the market, for using the low cost of manufacture of steel in the East about $8 per ton steel made from molten electric furnace pig iron would cost at least $34 and probably over $40, while that made out of Eastern pig iron which would have to be melted would cost at least $30 and probably $35.

As the high cost of pig iron prohibits the establishment of a tonnage steel plant, we will consider only an electric furnace plant for the production of high grade steel castings and shapes and bar steel.

Raw materials and labor. The principal raw material used in the electric furnace manufacture of steel

is scrap steel. While some scrap iron could be used, most of the material melted should be steel or wrought iron. Iron turnings, which in the open hearth are not especially desirable on account of oxidation losses, are about the most adaptable material for use in the electric furnace. There is not the high oxidation loss in the electric furnace that there is in the open hearth. Any scrap material used in the electric furnace must be small in size because of difficulty in operation of a furnace on large scrap iron due to short circuits. Formerly 2500 to 3000 tons of scrap iron and steel were used in Portland per month, and in addition 60 to 100 tons of turnings were produced. A large part of the turnings go to waste at present, and could be obtained cheaply. It is estimated that there is about the same amount available in Seattle, four or five times as much in San Francisco, and two or three times this amount in Los Angeles. It is probable that there is enough scrap steel available for a production of 26,000 tons of steel per year. Considering that a large part of this could be purchased in Portland where there are no steel foundries, the average cost at The Dalles should not exceed $15 per long ton.

Labor requirements are the same as in combustion furnace manufacture of steel.

Power. In the electric furnace manufacture of steel, electric energy is used at about the same voltage as in production of pig iron or ferro-alloys, but the electric steel furnace can not maintain as high a load factor as the electric iron smelting furnace or the ferro-alloy furnace. As it is necessary to transform the 11,000 volt current to 40 to 100 volts, a transformer and line loss of 5 per cent would occur. This, on the basis of 100 per cent load factor, would make the power cost $10.52 per horsepower year at the furnace. Owing to the intermittent nature of the electric furnace process in steel manufacture, a load factor over 80 per cent could only be maintained with difficulty. The power cost would then be $13.15 or 0.20 cents per kilowatt hour. If a lower rate were made on power, an electric steel furnace could use off-peak power to advantage on account of the intermittent nature of the process.

Cost of production. The estimate of cost of production of electric furnace steel at The Dalles is based upon an annual production of 25,000 tons and the utilization of 4000 horsepower. There are so many combinations of furnaces of different sizes with which a plant could be equipped that we will not attempt to specify them. The estimate is based upon steel cast into ingot form.

Cost of Production of Steel in the Electric Furnace at The Dalles, per long ton.

1.1 tons of scrap at $15 per ton	$16.50
Slag materials	1.00
Ferro-alloys	1.00
800 kw.-hr. at 0.20 cents	1.60
Labor	2.50
Maintenance and repairs	2.40
20 lb. of electrodes at 5 cents	1.00
Amortization, depreciation at 5 per cent each	1.50
Interest at 6 per cent	0.90
General	1.00
Royalty	0.50
Total	$29.95

The cost of production of ingot steel in the electric furnace at The Dalles would be about $30 per long ton. Adding freight rates to Portland, Seattle and San Francisco, the cost at these places would be $30.50, $32 and $34.50 for scrap iron and steel.

Market. There is very little market for billet and ingot steel on the Pacific Coast, and we do not believe that at the present time a tonnage steel plant manufacturing ingots for rails and heavy steel would be able to compete in the market with Eastern or foreign products. There is a considerable demand for small shapes on the Pacific Coast, and considerable steel is used in this manner. A plant casting into such steel shapes of its project would possibly be able to dispose of its product, but a large part of the steel shapes belong to machinery manufactured in the East, and most of this steel comes from the Eastern states.

Conclusions. We believe that under present market conditions, considering the cost of production, that the manufacture of electric furnace steel at The Dalles would not be profitable. As in the case of pig iron, steel in the form of ingots, billets, rails or structural shapes can be laid down so cheaply on the Pacific Coast from the Eastern states or foreign countries as to render profitable manufacture of this steel at The Dalles impossible. While a small electric furnace foundry, manufacturing special steel shapes and using 500 to 1000 horsepower, might be successful, it would not amount to much as a large scale producer. Tonnage steel cannot be made at a profit on the Pacific Coast at the present time, due to the high cost of production of pig iron, rendering a self contained iron and steel plant using either electric furnaces or combustion furnaces impossible, due to this high cost of production. Of course, as previously stated, the high cost of producing pig iron is largely due to the high cost and scarcity of a satisfactory reducing agent.

Copper. As stated previously in this report, the electric smelting of copper ores is entirely in the experimental stage. Before it can be practiced commercially much money and time must be spent on experimental work. While we believe it to be feasible under the best of conditions, the process is not in such a condition at the present time to warrant its use in a plant located a long distance from the source of ore supply, as would be the case at The Dalles. There are no available developed copper deposits whose ores could be smelted at The Dalles without paying a very high freight rate. We believe that when some of the Alaskan deposits have been more developed, electric copper smelting might prove profitable at The Dalles, as the ore in this case could be hauled largely by water. For the present, however, we do not believe an electric furnace plant for smelting of copper ores would prove successful at The Dalles. As the process itself is not fully developed, we do not consider it worth while to give cost figures.

Zinc. While electric smelting of zinc ores is more advanced than electric smelting of copper ores, it has not been yet proven to be a commercial success or in fact a technical success. Such being the case, it can not be seriously considered as a source of consumption for The Dalles power. Any ores used at this place would have to be hauled for a considerable distance by rail, from Idaho, California or Colorado, as there are no zinc ores in Oregon or Washington in any large quantity. With the process of electric zinc smelting

more fully developed, its use might be possible at The Dalles, but under present conditions we do not consider that such an enterprise would have much chance of commercial success. As in the case of copper, for the purpose of this report we do not consider the process enough developed to give cost data.

Conclusions as to the Market for Hydroelectric Power at The Dalles in Electrometallurgical Industries.

Our conclusions in regard to the market for hydroelectric power at The Dalles in electrometallurgical industries are summarized as follows:

(1) The market for hydroelectric power at The Dalles in electrometallurgical industries in general is not great, and under the best of present conditions as regards sale of this power the part consumed in electrometallurgical plants would be a very small proportion of the total possible development at The Dalles, which amounts to 300,000 horsepower of primary power.

(2) An aluminum could not be produced at The Dalles at much less than the low market price, we do not believe that an aluminum company operating there would be successful, with the possible exception of one of the established European or American companies, which has a market for its product. As such a company at the present time can make more money by manufacturing aluminum in the Eastern states near the ore and market, we do not believe that there will be much of a market for The Dalles power with such a company until all available Eastern water power sites have been utilized. A company manufacturing at The Dalles would have great difficulty in meeting Eastern market competition, and could not operate at a profit with aluminum below 18 cents per pound. Hence, we do not believe that there is any immediate market for Dalles power in the aluminum industry.

(3) Ferrosilicon could not be laid down in the Eastern market at a cost less than the present selling price, so that there is no market for power in the manufacture of ferrosilicon, although if ferrosilicon could be made at The Dalles at a profit, market conditions are such as to indicate a ready sale of the product.

(4) Ferrochrome could be made at a considerable profit in the electric furnace at The Dalles. The supply of this alloy in the United States is largely furnished by an Eastern company. While there would be strong competition for the sale of this material in the Eastern market, it is probable that a well managed company would succeed, and that there would be an ultimate market for 3000 horsepower in this industry at The Dalles, if such an industry was started on a small scale.

(5) In view of the estimated high cost of production at The Dalles and the small market for pig iron on the Pacific Coast at the present time, we do not believe an electric furnace pig iron plant would be successful financially at The Dalles, and so we do not believe that there is any possible market for Dalles power in this industry at present.

(6) Because of the estimated high cost of production of steel in a large tonnage quantity by the electric furnace process at The Dalles, there does not seem to be any chance for the development of a very large electric furnace steel industry at that place. For foundry work, however, the cost might be low enough and result in the sale of 500 h.p. at the start, which ultimately might be increased to 2000 h.p.

(7) Electric copper smelting and electric zinc smelting are still in the experimental stage, so that there can be no large sale of power for this purpose. Also the ore supply is very distant, making the success of such an enterprise doubtful.

(8) Among all the electrometallurgical industries mentioned above, there does not appear to be a market for over 5000 h.p. for the proposed development of Columbia River power at The Dalles.

A national electric range campaign is planned by the Society of Electrical Development. It has been suggested that the Society direct its special efforts to the securing and publishing of data showing cost of cooking. It was shown that in over 2800 communities a cooking rate of 5c or lower is in existence. Of this number over 70 per cent are 4c or lower and 27 per cent 3c or lower. It is recognized that the rate must be 4c or less to be sufficiently attractive to the householder. The society will publish specific data on the desirability of range business and to aid in conducting range campaigns. It was proposed that the society issue a booklet on how to put on a range campaign. Considerable stress was laid upon the suggestion that central stations include cost of installation in their range prices. In other words, quoting prices with the range installed, thus avoiding selling the range and having to then argue out cost of installation. It was decided to appoint a special committee to take up in detail the plans for a national electric range campaign. This committee to meet at Chicago, May 22d, 3 p. m., which will be N. E. L. A. Convention registration day.

Lewiston, Idaho, wishes to encourage investment of capital and the people have protested against the city council accepting the services of an engineer who offered to obtain a reduction in current rates for a contingent fee. As the Portland Oregonian points out: "The attitude of the people in this case received hearty approval from the newspapers of Lewiston and Boise, which pointed out that stagnation in development of Idaho, as of other states in the Pacific Northwest, is due to the excesses to which regulation and taxation of corporations have been carried. Being denied a fair return on their capital, investors have blacklisted these states and people suffer through lack of development. It is high time that the people of Oregon as well as other Pacific states changed their attitude toward corporations to accord with the changed attitude of corporations toward them. Prosperity in the East is creating a vast supply of new capital. It will come here if we turn a deaf ear to schemers like the man who made the proposition to Lewiston. The anti-corporation cry will soon die if the politicians find it is unpopular. If we continue to heed it, this new capital will go to other states and other countries. It does not need to come here. The United States now has practically the only supply of capital available for the whole world, and the investor will put it anywhere in the United States, Europe, South America or other countries where he can get good interest and security. We can get it if we offer the same attractions.

WATER RIGHTS AS A LIABILITY.

The Railroad Commission of California, in analyzing the value of the San Joaquin Light & Power Corporation for rate making purposes, has developed the fact that, in competition with oil at less than seventy-five cents per barrel, water rights have a negative value. The following data are taken from the commission's decision as written by Commissioner Max Thelen under date of April 6, 1916

Mr. C. E. Grunsky presented as San Joaquin's Exhibit No. 25 an estimate of the cost of generating electric energy by means of the corporation's present hydroelectric system as compared with the cost of generating an equivalent amount of electric energy in an assumed main plant and auxiliary plant operated by steam generated from oil.

Referring to the hydroelectric system, Mr. Grunsky assumed the installation of Power House No. 2, which is to be located on the North Fork of the San Joaquin River with a capacity of 2000 kw. Adding this capacity to the present installed capacity of the San Joaquin Corporation's hydroelectric system, Mr. Grunsky reached a total of 27,350 kw. installed capacity, which he used in his computations with reference to the corporation's hydroelectric system. The output capacity of Mr. Grunsky's substitutional all-steam plant was taken to be 31,500 kilowatts, of which 26,500 kilowatts would be installed at Bakersfield, where oil can be had at a low cost, and 5000 kilowatts at Fresno, as a stand-by.

Mr. Grunsky's conclusion is that with oil at 53.2 cents per barrel at Bakersfield, the total annual cost of operation, plus interest and depreciation, for the substitutional all-steam plant would be $578,736, while the total annual cost of operation, plus interest and depreciation, for an equivalent amount of electric energy generated by the San Joaquin Corporation's present hydroelectric system, assuming that proposed Power House No. 2 has been completed and is in service, would be $637,912. It thus appears on Mr. Grunsky's own figures that the annual expense in connection with the San Joaquin Corporation's hydroelectric system would be $59,176 in excess of the expense of the assumed substitutional all-steam plant. If this sum is capitalized at 8 per cent, it will thus appear that the San Joaquin Corporation's hydroelectric system, when Power House No. 2 on the North Fork of the San Joaquin River has been completed and is in operation, will have a negative value of $739,700 when oil costs 53.2 cents per barrel at Bakersfield. The prevailing price of oil at Bakersfield has been approximately 50 cents per barrel. Mr. Grunsky estimates that the annual cost of operating his substitutional all-steam plant, with auxiliary, will increase $5,667 for each one cent increase in the price per barrel of oil at Bakersfield. He reaches the following conclusion with reference to the relative cost of operating the San Joaquin Corporation's hydroelectric system and the assumed substitutional all-steam systems, with oil at varying prices per barrel at Bakersfield:

TABLE NO. XI.

Relative Cost of Operating Hydroelectric System and Substitutional Steam System with Varying Prices of Oil at Bakersfield, as computed by C. E. Grunsky.

Operating cost plus 8 per cent interest and depreciation.

Price of Oil.	Hydroelectric Plant. Total annual.	Hydroelectric Plant. Per kilowatt hour.	All-steam Plant. Total annual.	All-steam Plant. Per kilowatt hour
50c per bbl....	$633,624	$.00560	$560,602	$.00495
53.2c per bbl...	637,912	.00562	578,736	.00510
55c per bbl....	640,324	.00565	588,937	.00519
60c per bbl....	647,024	.00571	617,272	.00544
65c per bbl....	653,724	.00576	645,607	.00569
67c per bbl....	.....	.00578	.....	.00579
70c per bbl....	660,421	.00582	673,942	.00594
75c per bbl....	667,124	.00588	702,277	.00619

Mr. Grunsky concludes that with each advance of one cent per barrel in the price of oil at Bakersfield above 67 cents, there would be an advantage in favor of the hydroelectric plant of $4,327 per annum. In making his comparison, Mr. Grunsky confined himself to production costs and did not consider transmission costs, for the reason that he concluded that transmission costs would be substantially the same whether the power be generated by water in the mountains or by an all-steam plant at Bakersfield, with an auxiliary at Fresno.

Mr. Grunsky concludes that the negative value of the San Joaquin Corporation's hydroelectric system at prevailing prices for oil at Bakersfield should not be taken as reflecting upon the business judgment of those who have initiated and carried forward the enterprise of developing the water powers of the San Joaquin, Kern and Tule rivers. He is of the opinion that no deduction should be made from the value of the San Joaquin Corporation's physical properties, by reason of the fact that under existing conditions the corporation's hydroelectric system shows a negative value as contrasted with the possibility of generating an equivalent amount of electric energy by steam.

G. R. Kenny, statistician of the San Joaquin Corporation, presented as corporation Exhibit No. 26, an estimate of the value of two of the corporation's water rights, singly and consolidated, on the comparative steam plant theory but on assumptions different from those used by Mr. Grunsky. Mr. Kenny confined his computations to the water rights in connection with the North Fork of the San Joaquin River and the Kern River, leaving out of consideration the Tule River and the Merced Falls developments. He differed further from Mr. Grunsky in that he assumed an installation of 7500 kw. on the Kern River, whereas the present installation, used by Mr. Grunsky, is only 1350 kw. Mr. Kenny assumed a substitutional steam plant with a capacity of 25,000 kw., located at Bakersfield, with a reserve steam plant of 5000 kw. located at Fresno. Mr. Kenny's conclusions with reference to the value of these two water rights of the San Joaquin Corporation, singly and combined, on the bases used by him, appear in the following:

TABLE NO. XII.

Water Right Values of North Fork and Kern Canyon Developments at Varying Prices of Oil at Bakersfield, Computed by Mr. G. R. Kenny.

Price of Oil.	North Fork.	Kern Canyon.	Total.	Combination.
50 cents.....	$ 5,689.75	$1,057,210.37	$1,062,900.12	$1,067,335.25
55 cents.....	180,663.50	1,170,909.12	1,351,572.62	1,374,216.25
60 cents.....	355,637.25	1,284,607.87	1,640,245.12	1,681,097.25
65 cents.....	530,611.00	1,398,306.62	1,928,917.62	1,987,978.25
70 cents.....	705,584.75	1,512,005.37	2,217,590.12	2,294,859.25
75 cents.....	880,558.50	1,625,704.12	2,506,262.62	2,601,740.25

It will be observed that Mr. Grunsky and Mr. Kenny both used the substitutional steam plant

method, but that one engineer, using this method, reports a large affirmative value for the corporation's water rights, while the other using the same method, reports a large negative value. As going to the reliability of this method of ascertaining the value of water rights for the generation of hydroelectric energy, the following table will be interesting. The deficits shown in Mr. Grunsky's report are capitalized at 8 per cent per annum, in order to make his conclusions comparable with those of Mr. Kenny:

TABLE NO. XIII.

Comparative Conclusions of Grunsky and Kenny with Reference to Value of Water Rights of San Joaquin Corporation, on Comparative Steam Method.

Price of Oil.	Combined Developments. Kenny.	Grunsky.	Difference.
50c per bbl.....	+ $1,067,335.25	— $912,775.00	$1,980,110.25
55c per bbl.....	+ 1,374,216.25	— 642,337.50	2,016,553.75
60c per bbl.....	+ 1,681,097.25	— 371,900.00	2,052,997.25
65c per bbl.....	+ 1,987,978.25	— 101,462.50	2,089,440.75
70c per bbl.....	+ 2,294,859.25	+ 168,978.00	2,125,884.25
75c per bbl.....	+ 2,601,740.25	+ 439,412.50	2,162,327.75

In the foregoing computation the sign + means affirmative value, and the sign — means negative value.

It will be unnecessary for me to say that any theory which produces such strikingly dissimilar results, is open to the most serious question. If it were necessary to do so, attention might also be drawn to the unreliability of a theory which results in such varying water right values, shifting month by month and year by year with the varying prices of fuel oil and making the continuance of a stable rate base impossible.

Attention should here be drawn to the fact that the cost of production of hydroelectric energy assumed by Mr. Kenny in the foregoing computations is far less than the cost of producing hydroelectric energy assumed by the corporation in its cost of service computations as the basis for the establishment of rates in these proceedings. If it is fair to use a far lower cost of service in determining so-called water right values where the comparative plant theory is used, it would seem unfair to charge the public with any greater cost of producing power, when the cost of service computations on which rates are to be based are made. Mr. Kenny's estimate of the annual cost of production and transmission from the combined North Fork and Kern developments is $646,036.44. On the other hand, the utility claims that the actual cost of service for the comparable items, to be used by this commission in establishing rates, is $882,102.41. The following table shows a comparison of the cost of service estimates as presented by the San Joaquin Corporation in its Exhibit No. 27, and in its water right and comparative steam plant computations shown in its Exhibit No. 26:

TABLE NO. XIV.

Comparative Costs of Service Claimed by San Joaquin Light & Power Corporation as Between Cost of Service for Establishing Rates and Cost of Service for Establishing Water Right Values.

Estimated production and transmission cost, under present conditions, as shown by corporation's Exhibit No. 27	$882,102.41
Estimated cost of combined hydroelectric developments, as shown by corporation's Exhibit No. 26..	646,036.44
Comparative substitutional steam plant cost, as shown by corporation's Exhibit No. 26.....	731,423.26
Excessive present cost over steam cost.....	150,679.15
Excessive present cost over combination hydroelectric cost	236,065.97

The foregoing estimates of cost are based upon the present demand and output and can therefore be considered as directly comparable. From the foregoing table it appears that the present cost of service claimed by the corporation in its Exhibit No. 27, as the basis for establishing rates in these proceedings, is $150,679.15 in excess of the substitutional steam plant referred to in the corporation's Exhibit No. 26, and $236,065.97 in excess of the combined hydroelectric plants likewise referred to in the corporation's Exhibit No. 26. In other words, comparing Exhibit No. 26 of San Joaquin Light & Power Corporation with Exhibit No. 27, it would appear that the present installation of the corporation is extremely uneconomical. Capitalizing the excess cost, as claimed, of the present system over the cost of a substitutional steam plant at 8 per cent, it would appear that the present system has a negative value of $1,883,489 when the cost of fuel at Bakersfield is 50 cents per barrel. This value will remain negative, on this basis, even if the price of oil should be increased to 75 cents per barrel.

As already indicated, Mr. Kenny assumed the construction and operation of two hydroelectric plants which are not now in existence, one a 2000 kw. plant, to be located on the North Fork of the San Joaquin River, and the other a 7500 kw. plant, to be installed on the Kern River in lieu of the present 1350 kw. plant. The importance of this one element in the problem is shown by the fact that with oil at 50 cents per barrel at Bakersfield, the present development on the Kern River Canyon would show, under Mr. Kenny's figures, a value for water rights of only $151,191.50, as contrasted with the figure of $1,057,210.37 appearing in Table No. XII and based on an assumed development of 7500 kilowatts. This 7500 kilowatt plant is not in existence, and there is no definite evidence in the record as to when it will be built. I assume that it will be quite generally agreed that in determining the value of the water rights of the San Joaquin Corporation, consideration should be given only to the present development or to such additional development as can be confidently counted on for the near future.

Mr. Kenny, as already pointed out, has considered only the developments on the North Fork of the San Joaquin River and on the Kern River, which developments the San Joaquin Corporation apparently assumed might show an affirmative value. The corporation has entirely left out of its computations the Tule River development and the Merced Falls development, which developments, under the corporation's own theory, admittedly show a negative value. It is obviously improper when seeking to ascertain the value of a utility's water rights for the generation of hydroelectric energy, to consider only those portions of the utility's hydroelectric development which seem to show an affirmative value and to leave out of consideration entirely those developments which would show a negative value. The value of a utility's water rights should be ascertained only from a consideration of the utility's entire water system used and useful in its business. For these reasons, the computations presented by Mr. Grunsky are entitled to greater consideration herein than those presented by the San Joaquin Corporation's own employes.

In order to ascertain the result of the comparative steam plant method when properly applied to the facts of these proceedings, the commission has made an independent computation. The following table

shows the cost of generating hydroelectric energy in the San Joaquin Corporation's present system, based on the electric energy sold in the year 1914, not including general and administrative expenses and taxes:

TABLE NO. XV.

Water Right Valuation—San Joaquin Light & Power Corporation's Present System.

Capital—		
Production capital:		
Crane Valley reservoir	$1,177,044.56	
Power plants	3,389,538.70	
Total		$4,566,583.26
Proportion of transmission capital:		
Production plant substation equipment	$202,337.79	
Transmission lines	202,068.82	
		404,406.61
Total production and transmission		$4,970,989.87
Estimated return—		
Interest at 8 per cent		397,679.18
Depreciation:		
Production	$ 92,430.36	
Transmission 22.965 per cent	14,454.00	
		106,884.36
Expenses:		
Production	$132,977.58	
Transmission 22,965 per cent	8,208.13	
		141,185.71
Total return, not including general administrative, etc., and taxes		$645,749.26

In the foregoing table, the production capital and the estimated allowance for interest and depreciation have been taken from Mr. Kenny's report of the cost of service for the production system, as shown by Exhibit No. 27 of the San Joaquin Corporation. To the production capital has been added the estimated cost of power plant substation equipment and the cost of the transmission lines connecting the power plants with the main transmission lines, as shown in Railroad Commission's Exhibit No. 2. The transmission operating expenses and depreciation as reported by Mr. Kenny for 1914 have been prorated to this capital on the basis of relative investment. No general expenses or taxes have been included for comparative purposes. The Kenny values have been used in so far as possible.

The following table shows the cost of producing electric energy in two substitutional steam plants, one of which, with an installed capacity of 25,000 kw., is assumed to be located at Bakersfield, while the other, with an installed capacity of 5000 kw., to act as an auxiliary, is assumed to be located at Fresno:

TABLE NO. XVI.

Comparative Steam Plants at Bakersfield and Fresno, Cost of Production by Steam.

Main Plant.
25,000 kilowatts at Bakersfield.

Investment—		
25,000 kilowatts at $50	$1,250,000.00	
Overhead 17½ per cent	218,750.00	
	$1,468,750.00	
Substation equipment	146,750.00	
Total	$1,615,500.00	
Estimated return—		
Interest at 8 per cent		$129,240.00
Depreciation:		
Steam plant at 3.17 per cent	$46,559.37	
Substation at 3.62 per cent	5,313.00	
		51,872.37
Operation (running expense):		
Steam plant expense, other than oil and supplies	$41,418.44	
Supplies	3,373.74	
Substation expense	2,979.00	
Fuel oil, 481,421 barrels at 50 cents.	240,710.50	
		288,481.68
Total main plant		$469,594.05

Auxiliary Plant.
5000 kilowatts at Fresno.

Investment—		
5000 kilowatts at $50	$350,000.00	
Overhead 17½ per cent	43,750.00	
	$293,750.00	
Substation equipment	29,350.00	
Total	$323,100.00	
Estimated return—		
Interest at 8 per cent		$25,848.00
Depreciation:		
Steam plant	$9,311.87	
Substation	1,062.00	
		10,373.87
Operating expense:		
Steam plant expense other than oil	$9,000.00	
Substation expense	595.00	
Oil	13,500.00	
		23,095.00
Total auxiliary plant		$59,316.87
Total steam production (not including general expense or taxes)		$528,910.92

It will be observed from the foregoing tables that while the cost of production in the comparative steam plants, not including general expense or taxes, would be $528,910.92, the cost of production in the San Joaquin Corporation's present hydroelectric production system, is, on Mr. Kenny's computations with the necessary modifications, $645,749.26, with oil at 50 cents per barrel at Bakersfield.

The total cost of fuel oil under the present system of the San Joaquin Corporation, taking an average of 1913 and 1914 was $71,367.72. The cost of fuel oil in the comparative plant used in the commission's computations, assuming 50 cents per barrel at Bakersfield and 75 cents per barrel at the auxiliary plant at Fresno, would be $254,210.50, or $182,842.78 in excess of the actual consumption of the present system during 1913 and 1914. At 50 cents per barrel for oil at Bakersfield, the comparative plant would use 356,696 barrels of oil annually in excess of the existing plant. Hence it follows that for each 5 cents increased cost of oil at Bakersfield, the increase of the cost for the comparative steam plant would be $17,834.70.

The following table shows the value of the water rights of the San Joaquin Corporation, on the commission's computations, with fuel oil at varying prices at Bakersfield. The results are all negative:

TABLE NO. XVII.

Value of Water Rights of San Joaquin Light & Power Corporation on Commission's Computations on Comparative Steam Plant Theory.

50c per bbl.	—$116,838.34	—$1,450,479.00
55c per bbl.	— 99,003.54	— 1,237,544.00
60c per bbl.	— 81,168.74	— 1,014,609.00
65c per bbl.	— 63,333.94	— 791,674.00
70c per bbl.	— 45,499.19	— 568,739.00
75c per bbl.	— 27,664.34	— 345,804.00

The sign — means a negative result.

The origin of California oil is ascribed by Robert Anderson and Robert W. Pack in Bulletin 603 of the U. S. Geological Survey to organic matter once contained in the myriad shells of minute sea organisms now found in certain shales associated with nearly every known California field. These organisms were both animal and vegetable, foraminfers and diatoms, which were entombed in ocean and buried under superimposed sediments. Earth movement, pressure and moderate heat probably contributed to the formation of oil which is stored in reservoirs made by adjacent pervious sandy strata.

MILITARY ENGINEERING.

BY CAPTAIN RICHARD PARK,
Corps of Engineers, U. S. Army.
(Concluded.)

Illuminating Devices.

We come now to the subject of field search lights, flares and other illuminating devices. Night operations were carried on by the Japanese in the Russo-Japanese war with wonderful success, clearly foreshadowing the extensive use that is being made of night attacks in the present war. It is apparent then that suitable measures must be taken to light up the foreground and obstacles at night. It is the duty of the military engineer to construct and operate all such devices. The most efficient lighting is furnished by electric searchlights of high power, but it is recognized that it would be practically impossible to provide enough searchlights to illuminate the foreground of hundreds of miles of trenches, so other means of illumination must be used in addition to searchlights. The simplest substitute is the bonfire. Materials for these should be placed close to the line of obstacles, and should be anchored to stakes in the ground to prevent them being torn apart and scattered by the enemy. They are fired as soon as the sentries in the entanglements report the advance of the enemy. Other illuminating devices are flares, rockets, and bombs. During the period of about a year and a half preceding the European war, many excellent devices were perfected of this class. The parachute rocket is discharged from a specially designed pistol or rifle, and has a long duration of burning, the parachute to which the rocket is attached opening at the instant of explosion and acting as a reflector. The rays of light are reflected downward, and the illuminated zone is considerable. Flares are manufactured in compact form and several of them can be carried on the person. Bombs are manufactured for artillery fire and designed to light up hostile trenches at considerable distances to the front. The short period of effective illumination afforded by any one of these small devices is a handicap, but due to their compactness and cheapness, as compared to searchlights, they can be fired in any quantity and by discharging a second rocket or flare just before the preceding one goes out any desired area can be kept illuminated as long as desired. These lights have one great advantage over searchlights in that it is practically impossible for the enemy to destroy the light itself or the source of power.

Small portable searchlights have been tried out in our army at the various maneuvers. These are usually sufficiently small as to permit one man to carry the projector and its standard, and one or two men or a pack mule to carry the generating outfit, which supplies the burner with oxy-gasoline, acetylene or other gaseous mixture. The projector throws out for a distance of from 50 to 100 yd. a restricted cone of light of considerable intensity. These devices have not so far been used by our army in actual warfare, but the engineers are hard at work devising proper equipment along these lines, and undoubtedly there are large numbers of the latest and most efficient types with the engineer troops in Mexico.

Searchlights were first used effectively by the Russians in the Russo-Japanese war, at Port Arthur. The Russians used a great variety of steam boilers, engines and dynamos, and most of the lamps were apparently taken from the navy. They operated several lamps nightly and kept large areas of the foreground illuminated. They also used so-called star shells, being huge rockets filled with port fire which would illuminate the foreground for a few moments. The Japanese, however, had efficient portabe field searchlight outfits using gasoline engines driving dynamos which supplied power for 90 cm. lamps. After their siege works reached points close to the defenders' works they apparently found little use for their lights. The Russo-Japanese war showed that night operations, especially against permanent fortifications, would be the rule in future wars, and foreign nations, as well as the United States, set about improving their searchlight outfits for use with the mobile troops. Our first field searchlight outfit was a steam operated plant devised and purchased in 1900, and could hardly be called portable.

Later the Navy designed some really portable outfits for use at advanced bases, and about the same time the coast artillery corps designed some along similar lines for use at seacoast forts. About 1909 the engineers supervised the design of and purchased two different types. One is a horse or mule drawn outfit of two units, a gasoline engine and generator in one vehicle, and a 30 in. searchlight with controller and power cable reels in another vehible. The other outfit consisted of an automobile mounting a gasoline engine and generator. The truck was electric driven on the couple gear system, power being supplied to the wheel motors through a controller on the dash. The 30 in. searchlight was mounted on the two wheeled trailer and hauled behind the truck. There was sufficient power for the operation at one time of two 30 in. lamps. An additional 24 in. searchlight was designed to be operated from the top of a 40 ft. tower. The upper half of the tower telescopes with the lower half, which is hinged to the frame of a four wheeled wagon. For transportation the tower is lowered, turned back onto the wagon body, and the searchlight secured inside the framework.

Since 1910 the engineers have constantly been experimenting with a view to turning out the best possible portable outfits and there have been recently designed and put into commission several kinds involving the most modern features of foreign mobile searchlight outfits.

It is necessary that these outfits be designed and built in time of peace and that engineer officers and enlisted men be formed into searchlight companies and trained in their operation and repair. There is certain to be a need, in case the United States becomes involved in war with a foreign nation, for more searchlight outfits than will ever be provided for our army on a peace footing. At the end of a year's time a large number of outfits could be built in accordance with the latest models authorized as standard for the mobile army. In the meantime we would have to utilize such types of lamps and projectors of all candlepowers, and such generating outfits as could be improvised on short notice. There are a great many searchlights of various types in use throughout the United

States. These would be bought and mounted on small trucks. Small generating outfits could be improvised very quickly at the shops of our great electrical manufacturing concerns and also mounted on trucks. There is always on hand vast quantities of insulated wire, which would provide plenty of power cable. The operation or control of most of these searchlights would have to be by hand, since there is a scarcity of electric searchlights which are equipped with electric control devices. By control I mean the means used to turn the projector and therefore the searchlight beam from right to left and up and down.

For the operation, maintenance and repair of this improvised searchlight equipment, and also of the standard equipment that electrical concerns would be able to furnish by the end of a year's time, the Engineer Corps would need immediately upon the outbreak of war, a large force of electrical engineers. Neither the civil engineers nor the hydraulic engineers could help much in the operation of electric searchlights.

It is suggested that electrical engineers might organize in some way and offer their services to the War Department for enrollment not only with the searchlight companies or sections that would be formed at the outbreak of war, but also for service with the other arms where electrical devices and power are employed, such as the coast defense searchlights, the electrical maneuver devices of the great guns and mortars, or the light and power installations at seacoast batteries. They have the opportunity of seeing what we use in the way of electrical appliances at seacoast forts by going to seacoast forts and looking at them. They could seek and be given an opportunity to get instruction as to the way they are employed in the defense of cities. They should be given an opportunity to see what we have in the way of portable searchlight outfits for use in the field with mobile troops, and to learn their tactical employment in the attack and the defense.

It appears then that the basic engineering principles involved in the art of military engineering do not differ from those of civil engineering. In civil engineering, however, economy in cost is counted of greater importance than economy of time. In military engineering time is nearly always the most important point to be considered and any expense is justified that is found necessary for the speedy construction of a work which is necessary for success in battle, or the lack of which would bring disaster to our armies.

On the other hand, it will be apparent that the military engineer in addition to his knowledge of the engineering art must have a working knowledge of the art of war in all its phases, in order to apply his art in accordance with the tactical and strategical conditions involved. He must prepare the roads and other means of communication in such a way as to allow the rapid concentration of troops at their bases, or permit their swift advance to the attack. He must see that the camp sites are located properly and prepared with in view to giving the troops as much protection and rest as possible. He must select the sites for, and build the works that shelter the troops on the firing lines, and he is responsible that in the rear there are adequate roads, suitably prepared for use to cover retreat.

Summing up, I have stated that engineer troops with the mobile army are charged with the following main duties: map making, the laying out of camps, road and bridge work, including the care and operation of the floating bridge equipage, maintenance and operation of military railroads, laying out and supervising the construction of field fortifications and siege works, including obstacles, and the maintenance and operation of electric searchlights and other illuminating devices.

For the performance of these many and varied duties engineer troops are provided for our army to the extent of 248 officers and 2000 enlisted men. There are 3 battalions of 4 companies each. One company is at Vancouver Barracks, 3 on the border, 1 in the Canal Zone, 1 in Hawaii, 2 in the Philippines, and 4 in Washington, D. C. The law recently passed increases the mobile army to its war strength of about 125,000. The engineers are not affected by this increase. The engineers then form less than 2 per cent of the total strength. This force is totally inadequate to handle the duties it would be called upon to undertake in a great war.

To the engineers in civil life, then, the army must look to supply the deficiency in trained engineer troops. In case of sudden outbreak of war great efforts will be made to secure by voluntary enlistment large numbers of men physically fit to march and to fire a rifle. Under present conditions it is certain that the service of many engineers would be lost to the technical branches of the army through enlistment in the infantry which always forms the bulk of armies. It is somebody's duty therefore to make the peace time arrangement necessary to insure that civilian engineers will be assigned in time of war to technical positions in the army. The Corps of Engineers will need the majority of these trained men but there are many duties in other branches where engineers are also necessary.

Army men are given no authority to initiate legislation, in fact regulations distinctly prohibit them from so doing. Such measures must then be initiated and pushed through by the civilian engineers who are free to propose and work up any adequate legislation.

As you know a bill has been introduced in Congress calling for the establishment of a Reserve Corps of Engineers, which provides for the giving of commissions for all grades up to that of major to those who demonstrate their fitness, these commissions to be renewable at discretion of the Secretary of War every five years.

This is assuredly a step in the right direction. Whatever is accomplished along these lines, civilian engineers may rest assured that the army engineers will assist them in carrying out the provisions of legislation in every way consistent with existing regulations governing their actions.

The pioneer battalions unmounted carry in addition to their engineers' outfit the complete infantry equipment. Each pioneer company has a mounted section of 24 men equipped as cavalry and accompanied by a demolition section mounted on mules. The pio-

neer battalions mounted carry in addition to their mounted engineering outfit, the complete cavalry equipment, and are of about the same strength as a cavalry squadron. All engineer officers with the mobile army are mounted.

The greater part of this paper has been devoted to explaining the technical duties of engineers with the mobile army.

The few remarks on organization and equipment are sufficient to show you that the engineer is also expected to march like the infantryman, to ride as a cavalryman, and on occasions to fight like both. In a swiftly moving campaign the technical duties of engineer troops may occupy 10 per cent of their time, 90 per cent of their time is taken up in being just soldiers like all the rest. During 90 per cent of their time they are occupied with the duty of getting where they are needed, when they are needed there. During 10 per cent of their time they are intensively applying on military engineering work their technical knowledge gained through long years of training.

You engineers have already acquired the technical knowledge necessary to enable you with a very little instruction to apply it to military engineering. By enrolling in the Engineer Corps of California you will get an idea of the value of military organization, and will also have the benefit of such lecture courses and study courses as the War Department may be willing to supply, with a view to giving you instruction in the application of your profession to military engineerng.

A month at a business men's camp will give you some intensive field training, enough at least to convince you as to how little can be taught in a month, and how long a time is necessary to make one well trained for field service. You are already engineers, but in order to get where you will be needed when you are needed there, you must first, like the rest of us, be soldiers.

The Bell telephone system in Washington has been evaluated at $12,009,281 by the Washington State Tax Commission, an increase of $802,884 over the 1915 valuation.

An increase in municipal power rates has been ordered by the city council at Ellensburg, Wash., because of the inability of the plant to pay expenses. The Ellensburg plant has been run for several years on low rates and has been used as an advertising feature on the advantages of municipal ownership. The plant became buried under a monument of debt and the people of Ellensburg awoke to the fact that they have to charge higher prices or let the town go dark.

The legality of exclusive selling agreements has been ruled upon several times by the Federal Trade Commission, the decision invariably being that exclusive contracts are not unlawful unless they tend to cause monopoly. Neither the Federal Trade Commission Act nor the Clayton Act prohibits manufacturers from selling their product exclusively through one dealer in a given territory nor from denying the dealer permission to sell outside his assigned territory. The commission has not yet passed upon the question as to whether it is lawful for a seller to contract with his buyer not to sell the goods of another manufacturer.

SOME PROBLEMS OF INDUCTIVE INTERFERENCE.

(Concluded.)

L. T. Merwin: This looks like a slate—all here in a bunch and called on in rotation, and if it is I am going to attempt to break it. The spirit of co-operation should be rife here, particularly toward enlightening power men on the telephone man's troubles; and telephone men themselves should co-operate to intelligently inform the power men of their difficulties. There is a lot we power men do not know about the telephone business and it is possible that there are some things that the average telephone man does not know about the difficulties that beset an operating engineer with a power company. I feel quite lost when I go into the telephone building or the central exchange, and view the wonderful complexity of the equipment required for the handling of intelligence. I venture to say that the average telephone man would also feel just as much lost if suddenly put down in a modernly equipped steam-electric station and told to operate it. There is some contrast between the minute voltages and currents that the telephone man handles and the relatively tremendous currents and voltages of a modern electric station.

To break the slate—I want to ask a few questions of the telephone men—questions about things I want to know. All I know about telephony is what I have imbibed working with a little sixty-mile private telephone line that I had to make work. We simply had to talk to the power house from Portland and we couldn't. It was a puzzle to me. A telephone man would have put that line into shape in a jiffy and it would have been easy for him, but I am not in the telephone business. The power conductors, however, worked fine. I have heard them way over there on West Park and Alder street in the central exchange. Yes, the power conductors worked dandy, but the telephone simply would not. All I could get was a terrific roar, so I endeavored by hook or crook, blindly, to apply to the thing what the telephone people tell us must be done, namely transposition. Our power line and telephone conductors you understand, were already strung. In building the line we had to go through very rough country along the north bank of the Columbia and merely hit the high places so that our spans varied from 16 ft. to 1400 ft. Our conductor spacing varies from a 7 ft. triangle to a 7 ft. flat construction and then back again to a scalene triangle with a base of 15 ft. and an altitude of 6 ft. No two adjacent spans were the same for fifty miles due to the configuration of the ground, and you can imagine a mere power man trying to transpose in order to get a workable telephone with those power conductors now spraddling out and now coming in closer together as we hit the high places. It can't be done. At least I could not do it. Probably a telephone man could have accomplished it. The company was new and unlimited funds were not at my disposal but it was up to me to get that thing working. And it was in meeting and partially overcoming these difficulties that I came across and met the facts that brought me face to face with some of the difficulties the telephone man comes up against when it comes to the matter of interference from power lines. But now suppose the long distance telephone line of the Bell Company had been along the same side of the river with our lines on the north side. Suppose they had originally been on the north bank and we had desired to put our lines through there. I wonder if it is possible by mathematical analysis to have figured out a scheme of transposition that would have made the toll line usable. The chances are that the telephone people would have followed somewhat the route of the railroad along the north bank. They would have paralleled us from Camas up as far as White Salmon. In order to have maintained their standard spacing it would have been necessary for them to follow approximately the route of the railroad. We had to get our right-of-way wherever we could. Mr. Griswold would doubtless sing the praises of the rich farm lands of California but I want to tell you that there is no land held

so high in California as some of the rock piles we had to go over in getting our right-of-way. We had to take whatever we could get. The rocky points were high and irregular, so you see it is quite a complex parallelism.

Would it have been possible with our sort of a power line and spans to have figured out a scheme of transposition that would have fitted the case? Now, the power man, in this case myself, if you wish, would have had to take the telephone man's word for it that this could be done. He would say to me, "You put your tranposition here—and here—and there—and another here—and put two in here," and so forth in that manner. Now, suppose that were done, would it solve the problem? Would it clear up the line? I don't know. I would have to take the telephone man's word for it. If he told me to do it and if he had a commission's power behind him which urged me on, I would have doubtless put them in just as he dictated. They would have gone in all right. Now, suppose we thought it had been worked out satisfactorily, and then after the first month's or day's operation they came around and said, "Put another transposition in here and one there and another one here, and it will be fine and dandy." Having done that we hope, of course, it would be fine and dandy. But maybe it would not, and then what?

Now this may be an exaggeration, but our line along the north bank of the Columbia River is in exceptionally rough country, and the solution of the whole problem and the overcoming of the difficulties of induction by transposition may be feasible and satisfactory to both parties, but I doubt it.

Now, from the power operators' standpoint, let me put another question. I ask for information. Let this represent the power house right here (indicating). Here is Camas eighteen miles from Portland across the river on the other side. A number of air break switches (indicating) at the Camas sub-station control the two towns of Camas and Washougal, and the Crown Willamette Paper Mill with a load of some 5000 h.p. Just outside the power house at White Salmon is another (indicating). At Stevenson is another. In Portland is another. We use the air break switches to facilitate the exact location of troubles when they come. Now, according to the California rules, the operation of these switches must follow the exact wishes of the communication companies. We could not operate any of these under any kind of load if it disturbed the transmission of intelligence and thus upsets the routine of community life. But here is a case:

Suddenly, while sitting in my office where I have the distinction of being the chief operator, load dispatcher, and a few other things, I hear a grunt downstairs in the steam plant and I know that there is trouble; that there is a disturbance on the lines, and soon I am notified that the high line is down, or say, that the high line is not down—but the telephone bell begins to ring most violently and unnecessarily, and I immediately know that there is trouble. I phone to Albina substation across the river and learn that we are still hanging on but that there is high voltage on the phone lines. The power house calls up in a hurry and so does my good friend, Mr. Hendrickson, at Washougal, who operates the Farmers' Co-operative Lines. He says to me, "You have put me out of business entirely." Probably Mr. Morden will get word from the Crown Willamette Mill that his lightning arresters are shooting over, and I come to the conclusion from all this that we must have an arcing ground on the line, Now, what do I do? There is no question but what the telephone companies are in a state of disturbance, for I again hear from Mr. Hendrickson and he informs me he is in an awful fix. The Farmers' lines coming in to his switchboard are grounded lines and you telephone men know that he is really in distress. What shall I do? I hastily get our local manager at Camas to the switching station and tell him to phone to the power house to take a certain amount of load—or drop a certain amount of load so that the load they generate would be equivalent to the Crown Willamette demand and leave the Portland load on the Pittock station. Then, I tell him to open air break switch No. 3 at Camas and he reports switch No. 3 is open, and then we open our Portland switch and find Mr. Hendrickson is still in trouble and continues to call in. All right. We close here first, then we synchronize there, and I have this switch closed and that switch open and find that Hendrickson is fine and dandy, and have located the trouble somewhere between here and there (indicating). We have not interrupted the load of the Crown Willamette Mill, nor lost out in Portland, and we disturbed the communication circuits but a few minutes in certain local quarters.

Now, the thing of the California commission is, I believe not to disturb the channels of communication no matter what you do to your power line. But, in a spirit of fairness, I think any telephone man will admit that from the standpoint of the public it was just as important to maintain power service as it was to maintain the channels of intelligence. In this particular instance where the greatest disturbance was across the river in a sparsely settled community it was far more important to maintain power service than it would be to maintain in its integrity the channels of communication. But, the order of the Railroad Commission of California does not take into consideration the relative importance of these two things: the disturbance of the channels of communication, or the dropping of a power load. Now, I did the best I could. I probably broke two or three thousand k.v.a., wattless, in opening the switches and of course that temporarily interrupted the line or channels of intelligence.

Now, as to the charging of lightning arresters. Of course, the telephone men never have any troubles with road contractors interfering with their line by blasting operations, but we power men do, and in Washington where there has been quite a spasm of road building, we have suffered quite considerably. As a matter of fact, ninety per cent of our troubles since the line has been in operation has been due to indiscreet actions on the part of irrepressible road contractors. The other day out at Wind River, with the wind blowing very hard, blasting operations two hundred yards away from the line wafted a big root right across two of the conductors of the power line on a span where we had flat construction. The power house hung on its gates and tried to burn the obstruction off, a procedure not exactly approved by the telephone men but followed by power operators. Of course, I won't tell you what the average power station operator would say if he got an order: "Don't hang on there, you are interfering with Farmer Simpkins' telephone line at Washougal." He probably would hang right on. He would burn off the thing if he could, but in doing this, of course, he might cause other damage as was done in this particular instance with the lightning arresters at our Albina substation, breaking down the charging resistances and puncturing one stack of cones. Now, you know the cell films of electrolytic lightning arresters must be maintained, and so we had to make a makeshift connection to keep the others in service, even in crippled condition. This required frequent charging until the disabled stack was repaired. However, that would be directly against the order of the Railroad Commission of California. Lightning arresters must be charged, it says, at 2 a. m. or at sometime not here settled upon, but to be determined to the best interests of the telephone company, even at the expense of losing the balance of our arresters, that is, if this rule were strictly adhered to, but I realy don't believe the telephone company would hold us to it. On a frank explanation and a statement of what the situation was they would say, "Go ahead and charge your arresters if absolutely necessary." But, I am speaking of the exact letter of the law; and under the ruling such a procedure would be unlawful.

Another point; in my haphazard investigation of this

(Concluded on page 347.)

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The Parable of the Talents

A certain nobleman went into a far country to receive for himself a kingdom, and to return.

And he called his servants and delivered unto each of them a talent, and said unto them, Occupy until I come.

And it came to pass, that when he was returned, having received the kingdom, then he commanded these servants to be called unto him that he might know how much every man had gained by trading.

Then came the first, saying, Lord thy talent hath gained ten talents.

And he said unto him, Well done, good and faithful servant; because thou hast been faithful in a very little, I will make thee ruler over much.

And the second came, saying, Lord, thy talent hath gained five talents.

And he said likewise to him, Well, thou good servant, thou hast been faithful in a few things, therefore have thou authority over many things.

And another came, saying, Lord, behold, here is thy talent which I have kept laid up in a napkin.

His Lord answered and said unto him, Thou wicked and slothful servant, thou oughtest to have put my money to the exchangers, and then at my coming I should have received my own with interest.

Take thou, therefore, the talent from him and give it unto him which hath ten talents. For unto everyone that hath shall be given, and he shall have abundance; but unto him that hath not shall be taken away even that which he hath.

Consider the federal bureau as the nobleman in the far country, the people of the Western states as the servants and the natural resources of the West as the talents. While certain of these servants would develop these resources for the benefit of all, others would keep them laid up in a napkin. Meanwhile the nobleman in the far country hath little understanding of conditions at home and chastiseth the faithful servant and maketh the slothful servant ruler over much.

Such, at least, is the way that the non-use of wasting water power looks to most of the Western people. The Pinchot conservationist, like an older brother to a younger, says we have spent our inheritance riotously, and therefore you should dig a hole in the earth and hide your inheritance away so that our children's children may enjoy it.

Waterpower, especially, is conserved only when used. Hoarding is wasting. Non-use is a wicked waste, not only of the waterpower, but of the fuel which is being needlessly used to do those things which might be done hydroelectrically. Over-production and lack of a market has made it possible to purchase fuel oil at Bakersfield, California at fifty cents a barrel. Assuming that four barrels of oil have the same heating value as one ton of coal, this price is equivalent to coal at two dollars a ton. Water power cannot compete with steam power on the basis of such an abnormally low fuel cost. Consequently, water power sites, today, are worth less than nothing, that is, they have a negative value, in accordance with the decision of the California Railroad Commission in the San Joaquin Light & Power Corporation rate case, as detailed elsewhere in these columns.

This state of affairs is temporary. The ultimate realization of the dream of "dollar oil" will, on the substitutional theory, convert water power liability into water power asset. But until conditions do change, there is no present profit in marketing hydro-

electric power in competition with steam-electric power made by squandering petroleum, which is invaluable as a source of gasoline and lubricating oils. Nearly half the entire crude oil production of this country is being foolishly burned under boilers and inefficiently used in the manufacture of artificial gas, whereas these duties can be better performed by electricity and the oil be available to cut down the high cost of gasoline and lubricating oils.

Ordinary common sense would seem to suggest that any man who is willing to expend energy and capital in developing water power that is now running idly to the sea should be encouraged as a real conserver of oil and timber. He might even be given a bonus for dedicating his ability and money to the public service.

But the Pinchotites do not see it in that light. They have been imbued with the false idea that water power is cheap. They look to an excise tax on hydroelectric plants as a means of raising needed revenue. They have hedged every possible power site with such hindrances as to effectually deter any would-be developers except those whose immediate necessities have forced them to terms.

Eight years ago this journal pointed out the inadequacy of the proposed Forest Service regulation as an aid to water power development. Then we were as a voice calling in the wilderness. Today, even the Forest Service officials admit the truth of our prophecy and seem willing to meet power company necessities half way.

But the muck-raker continues to prate about a water power trust robbing the people, public passion is inflamed and the problem seems little nearer to a solution than before it became a political issue. In the April number of "The World's Work," for example, appears a one-sided article whose author even accuses large corporations of resisting the alleged efforts of conservationists to open up the public domain!

In the meantime, oil-burning locomotives are inefficiently doing the duty of electric locomotives, irrigable lands are without water which might be electrically pumped and the natural growth of a vast region is being stunted. Surely some form of relief can be provided whereby the needs of the people can be protected and the rights of the investor assured.

The Menace of Uncontrolled Labor

An organization even stronger than that of the Prussian army, is gradually being built up in America by organized labor. Each was forced into existence by a dire necessity for defense. German weakness after the Franco-Prussian war was on a par with the plight of unorganized labor as being exploited by organized capital at about the same time. Consequently, common humanity sanctioned the building up of a German defense and the American public encouraged the organization of labor to get higher wages and shorter hours. Each was a defensive alliance.

But the change from a means of defense to one of offense is easy, the difference between armor and arms is slight. Furthermore, those owning offensive weapons are quick to take offense, if only to justify possession. So labor has recently assumed the offensive. For it not only appreciates its own strength but also apprehends the weakness of capital as fettered by public regulation.

Capital was the first to be regulated because it was the first in its aggressions on the principles of democracy. Yet few people seem to be aware that the excesses of labor are now even a greater menace to the American ideal of equal rights to all than was ever offered by capital, nor do they perceive that the task of controlling labor will be far more difficult than that of regulating capital.

Labor has no property to be held as a hostage for good behavior, its leaders are irresponsible and the union is exempt from the supervision to which the rest of society is subject. Labor organizations are taught the doctrine of resistance to law, members are forbidden to join the National Guard and in England is the sad spectacle of workmen "trying to hold the arm of their native land when it is fighting for its life." In the United States the mine workers are planning to create a coal famine next winter, the railroad employes are arranging for a tie-up of transportation facilities this summer, and even now industrial workers are suspending manufacturing operations. And who are the real sufferers, if not the public?

There is much greater danger of the rise of special privilege and the fall of equal rights threatened by the dictatorship of a labor leader than was ever dreamed of by the deposed oligarchy of capital. National safety required that capital be prohibited from monopolizing any industry or public service without the strictest of regulation. Yet the perilous power to paralyze industry is trustingly to be placed in the hands of uncontrollable and irresponsible men if the recommendations of the Federal Industry Commission are adopted. This commission has given its approval to the right to strike, the right to boycott and the right to dictate terms of employment—all without the least restriction. Here is a threatened tyranny of labor that demands the action of an outraged public. Have the people any reason to believe that, in case the United States were at war, the coal miners, railway engineers or Westinghouse strikers would do otherwise than they are now doing? In time of peace, then let us prepare to handle such difficulties whenever they may arise.

Such preparation does not in any way involve the dissolution of the wonderful organization that has been built up by labor. But, like a fine piece of machinery it needs a governor to prevent its destroying itself in a frenzied burst of power. A clock without a regulator is no more useless than a labor federation without adequate means of public control.

In the peaceful providing of proper regulation let an oft-forgotten fact be remembered—the worker's economic interest lies with the employer he works with, rather than with the workers of concerns competing against his employer, and the employer's economic interest lies with his employe, rather than with rival employers. This identity of economic interest requires that the workers have a share in the profits and likewise stand ready to share in the losses. With the present intractibility of labor such an ideal condition seems difficult of attainment. But education along proper lines, backed by the firm demand of an awakened public opinion will ultimately bring about its realization. Thus will the unity of interest cement the present diversity of aims.

PERSONALS

Harry Sayles, salesman for the Holabird-Reynolds Company, is at Los Angeles.

W. Brewster Hall of Pass & Seymour Co. has returned to San Francisco from Los Angeles.

W. D. Steele, vice-president of the Benjamin Electric Manufacturing Company, is at San Francisco.

S. Headman of the Power Equipment Company of San Francisco has returned from a short trip to Colusa.

C. V. Schneider, manager of the Electrical Supply Company of Sacramento, was at San Francisco this week.

Gerard Swope, vice-president and general sales manager of the Western Electric Company, is at San Francisco.

Allen Jones, sales engineer with the General Electric Company, has returned to San Francisco from Schenectady.

Clover Anderson, representative for the Electric Appliance Company in Oregon, is in San Francisco for a short stay.

B. J. Klein, Pacific Coast manager of the Bristol Instrument Company, has returned to San Francisco from Los Angeles.

H. P. Stow, following the death of F. J. Symmes of the Thos. Day Company of San Francisco, has been appointed general manager.

J. C. Hayes of the Hayes-Van Fleet Company, electrical dealers and contractors of Santa Rosa, spent a few days last week at San Francisco.

J. W. Thompson, electrical department of the H. W. Johns-Manville Company at Los Angeles, is spending three or four weeks at El Paso, Tex.

Harry Gall has been appointed general manager of the Douglas County Light & Water Company at Roseburg, Ore., succeeding **C. R. Beese,** resigned.

H. B. Kirkland, vice-president and general sales manager American Conduit Manufacturing Company of Pittsburgh, is at San Francisco for two weeks.

R. H. Coyne, Pacific Coast manager of the Kellogg Switchboard Supply Company, has returned to San Francisco after an extended trip throughout the Coast.

H. Havey, salesman with the Electric Appliance Company, has returned to San Francisco from a business trip to Nevada, where he reports business as flourishing.

F. S. Mills, formerly illuminating engineer at Los Angeles, has been made supervising engineer for the National X-Ray Reflector Co. and will establish offices at San Francisco and Los Angeles.

W. S. Greenfield, manager of the San Francisco and Los Angeles offices of the H. W. Johns-Manville Company, has returned to San Francisco from a short trip to Nevada and the Sacramento valley.

H. Kihara, electrical engineer of Talaita & Company of Tokyo, Japan, and **N. Kishi,** chief engineer of the Osaka Electric Light Company of Osaka, Japan, who have been touring the United States for the past two months, have returned to Japan.

George R. Murphy, Pacific Coast representative of the Electric Storage Battery Company of Philadelphia, who has been for the past month in the northwestern territory, is expected to return to his home office at San Francisco about the first of the month.

Attilla Norman, general manager of the Oregon Power Company, has been appointed chairman of the finance committee of the Eugene Chamber of Commerce, and **F. E. McKenna,** local manager of the Oregon Power Company at Coquille, Oregon, has been elected secretary and treasurer of the Ko Keel Klub.

George C. Mason, vice-president Hurley-Mason Company, Portland; **Bert C. Ball,** president and manager Willamette Iron & Steel Works, Portland; **O. B. Coldwell,** general superintendent Portland Railway, Light & Power Company, Portland; **O. F. Stafford,** professor of chemistry and director of the chemical laboratories University of Oregon, Eugene, and **A. M. Swartley,** bureau of mines and geology, Corvallis, have been appointed Oregon members of the National Industrial Survey by the Naval Consulting Board.

MEETING NOTICES.

Pacific Coast Railway Electric Club.

The club met at the West Alameda shops of the Southern Pacific Company on Friday evening, April 21st, and enjoyed a trip through the big shop, including lectures, demonstrations and workings of the suburban electric cars.

San Francisco Electrical Development and Jovian League.

President E. M. Cutting presided at the meeting of April 19th, for the first time in several weeks because of his absence in the east. Theo. Dredge, as chairman of the day, carried out the military spirit of the meeting by means of a bugler who sounded the several calls preliminary to introducing Col. E. P. Mathewson, who gave an interesting talk on "Preparedness," with special reference to the National Guard. The league accepted an invitation to visit the local armory and inspect the artillery equipment.

Utah Society of Engineers.

The Utah Society of Engineers held their annual banquet and election of officers in the supper room of the Hotel Utah, Wednesday, April 19. Guy Sterling, a well known Salt Lake civil and mining engineer, was elected president; C. J. Ullrich, vice-president; W. A. Wilson, second vice-president; Hugh C. Lewis, secretary, and R. B. Ketchum, member of the executive committee. Eighty members were in attendance at the banquet. W. C. Ebaugh presided as toastmaster. Heber M. Wells, city commissioner, responded to the toast "Municipal Problems," in which he outlined the importance of the engineer in connection with the civic and industrial problems of municipality as well as in other walks of life. The Rev. Peter A. Simpkin responded to the toast "Eternal Engineering," which proved to be one of the most timely and interesting addresses ever given before this society. The members of the banquet committee were Fred Ulmer, John Jones, Frank W. Moore and S. S. Arentz.

Los Angeles Jovian League.

J. Harry Pieper, former president of the league and fourteenth Comus of the Jovian Order, presided at the meeting, April 19th, in the absence of President Holland. One hundred and sixty Jovians crowded the new banquet hall of Jahnke's cafe, to be gastronomically entertained and to listen to the witticisms of Matador Pieper, who never fails to make things interesting whenever he presides. The exchequer was considerably enriched by Pieper, who being no respecter of persons and exercising the authority of the chair to the limit, proceeded to fine the members in a most "scandalous" manner. However, it was done in such a clever and mirth-provoking way that it was greatly enjoyed by all. The money thus collected will be used to defray future program expense. After everything but car-fare had been extracted, the gavel was turned over to H. P. Hubbard, chairman of the day and master of ceremonies, who provided a fast and furious feast of fun and frolic in an entertainment which was away ahead of anything that has been given in the past. The College Inn Sextette—a company of very clever instrumentalists—and Master Eddie Van Schaik—"the McCormack of the Cafes"—were the principal attractions. Duke Stone, Ex-United States Prosecuting Attorney, made a short talk, relating some amusing stories and interesting experiences.

APPLICATIONS TO CALIFORNIA WATER COMMISSION.

Albert Givan of 1525 K street, Sacramento, has been granted a permit to appropriate 15 cu. ft. per sec. from the American River for the purpose of irrigation in the Carmichael Tract, also for fire protection and other domestic purposes. The water will be conducted to the colony by means of a pipe line 7½ miles in length, the means of diversion being a pumping plant, with re-inforced concrete pumping station, with one twelve inch, eight inch and six inch electrically driven pumps. The land to be irrigated consists of 3100 acres and the estimated cost of the system is $52,250.

The Blevins-Mallon Ditch Company of Colusa has been granted a permit to appropriate 42 cu. ft. per sec. of the waters of the Sacramento River, to be taken out at a point in the Jimeno Rancho near the northeast corner of the Clara Packer ranch and through a main canal two and a half miles in length, to be used in the irrigation of some 1800 acres of land in the above county. The water is to be lifted 17 ft. from the river into the main canal by a 24 in. centrifugal pump connected to a 125 h.p. electrically driven motor. The estimated cost of the system is $11,000.

John F. Mauck of Calneva, Cal., has applied for permission to appropriate 120,000 acre-feet per annum of the waters of Honey Lake for irrigation purposes. In the application data are shown two main canals 22 miles in length to be known as the Triangle Ditch. There are no diversion works, the water to be pumped direct into the canal from the lake by means of a pumping system estimated to cost $200,000. The canal at the headgate is 24 ft. wide at the water line and 20 ft. on the bottom, with a fall of 4 in. per 1000 ft. At 1½ miles from the headgate the canal is 15 ft. wide on top and 7 ft. on bottom with a depth of water of five feet. At this point the main canal separates into two divisions to be known as North and South canals. The estimated cost of the ditches and canals is $400,000.

Wm. L. Wales of Woodland has applied for permission to appropriate 500 second feet of the waters of Willow Creek, tributary to the Susan River in Lassen county. The plans of the project are incomplete, any further than the applicant states that it is proposed to irrigate 50,000 acres of land, which would indicate a project of a million dollars or more in case it were perfected.

The Mojave Mutual Land & Water Company of San Francisco has applied for permission to appropriate all the water in Oak Creek watershed, including all of the waters of Oak Creek, Mill Creek, springs and all the run-off and flood waters, not less than 70 cu. ft. per second for purposes of irrigation. The application sets forth a ditch seven and one-half miles long to be known as the Mojave Plain ditch. There is a proposed dam 100 ft. high, 600 ft. on top and 300 ft. on bottom, built of concrete with wasteway around dam. There is a proposed storage capacity of 50,000 acre feet. The land to be irrigated consists of some 61,440 acres in Kern county and the estimated cost of the works is $400,000.

The California Chief Development Company, care of Chas. P. Brooks, Salt Lake City, has applied for permission to appropriate five second feet of the waters of Owl Creek and Gray Eagle Tunnel in Placer county for mining and milling purposes. There is a diversion and storage dam of timbe crib and loose rock, a pipe line three-eighths of a mile long, with a total fall to be utilized of 1000 ft., designed to produce 568 theoretical horsepower, by means of a Pelton wheel and dynamo unit. The water is to be returned to Owl Creek after use. The estimated cost of the works is $20,000.

W. L. Wales of Woodland (as trustee for F. L. Rinker and others) of Calneva, has applied for permission to appropriate 500 cu. ft. per sec. from Susan River, tributary to Honey Lake, Lassen county for irrigation purposes. The proposed diversion contemplates the irrigation of 50,000 acres of land. The same applicant has also made application for another diversion of 500 sec. ft. of the waters of Eagle Lake for the purpose of irrigating the same land.

M. L. Hazzard of Whittier, Los Angeles county, has applied for permission to appropriate 2000 sec. ft. of the waters of San Dimas canyon, tributary to San Gabriel River for the purpose of storing said waters to prevent destruction of property and for use in irrigation. In the proposed works there is a canal four miles long, a concrete diversion dam, a storage reservoir impounding 15,000 acre feet, the dam to be 130 ft. high, 550 ft. on top and 25 ft. at bottom, with a width on top of seven feet, said dam to be of the arch principle, concrete construction. The estimated cost of the works is $350,000.

Leon Bly of 1350 Washington street, San Francisco, has applied for permission to appropriate waters of Balls Canyon Creek and Willow Creek tributary to the Susan River in Lassen county. The application asks for 50,000 acre ft. per annum to be stored on Balls Creek and 500 cu. ft. per second to be diverted from Willow Creek. There is a proposed canal 21 miles long connected with the project, further data of which is to be supplied. The lands to be irrigated are in the north end of Honey Lake Valley.

W. L. Wales of Woodland has applied for permission to appropriate 500 cu. ft. per sec. of the waters of Skeedaddle Creek, tributary to Duck Lake in Lassen county. The plans are not set forth in the application, any further than it states that it is proposed to irrigate 50,000 acres of land.

H. A. Unruh of Arcadia, Los Angeles county, has made application for permission to appropriate five cu. ft. per sec. of the waters of Santa Ana stream by means of a dam and water distributing system, at an estimated cost of $30,000. It is intended to water some 1000 acres in the Santa Ana Tract of the City of Arcadia.

B. A. and A. A. Wilson and L. D. Fay of Lidell, Napa county, have applied for permission to appropriate 12½ sec. ft. of the waters of James Creek, which sinks into Pope Valley, for purposes of power to be used at mines. The main flume which is one-third of a mile in length is called the Twin Peaks Canal. There is a proposed diversion dam, a total fall to be utilized of from 100 to 150 ft., generating about 10 theoretical horsepower at a cost of approximately $500.

The West Side Irrigation District, with headquarters at Tracy, has just filed its application for permission to appropriate 225 cu. ft. per second of the waters of Old River, tributary to the San Joaquin River in San Joaquin county. This is one of the last steps in the effort of the farmers of that rich section of Central California to apply the water to their lands. The organization of the district under the state laws, was completed last October, after a long struggle on the part of the majority of the land owners of that district, much opposition having been met with as in the majority of similar cases. This will be one of the most modern and up-to-date districts in the United States when completed. At present there are about 12,000 acres included within the district, but ultimately about 6000 acres more will be added. The water will be raised into the ditches by means of an immense pumping plant of latest design. The estimated cost of the works is $285,000. The district has asked the commission six months' time in which to file their complete data.

Leon Bly of 1350 Washington street, San Francisco, has applied for permission to appropriate 300 cu. ft. per second of the waters of Susan River, the diversion sought being the surplus and unappropriated water to be taken during high water season and conveyed through Pine Creek to Eagle Lake and there stored for irrigating lands in Honey Lake Valley.

ELECTRICAL LEAGUE BASEBALL.

Last Saturday, April 22d, marked the opening of the Electric League, composed of the following teams: Electric Appliance Co., Electric Railway & Manufacturers' Supply Co., General Electric Co., Pacific States Electric Co., Westinghouse Electric & Mfg. Co., and Western Electric Co.

The league has chosen as their official park, the grounds of the Ocean Shore Railroad Co., at Twelfth and Mission streets, San Francisco, where all of the league games will be played every Saturday afternoon.

To put the league on an independent financial basis the teams have arranged for a dance to be given Friday night, May 5th, at Maple Hall, Polk and California streets. The object of this dance is to raise money to pay the expenses of the league, and we are planning for a great jollification for all of the fans and their friends, and we know that all who attend will have "some time."

Following is a detailed report of the first games of the season: Electric Appliance Co. vs. Electric Railway Mfg. Supply Co. The game called at 2:50 p. m. opened with Ermsco in the field. The wind was blowing hard, which made it almost impossible for any of the pitchers to use any "stuff" at all. The result was that the game was a regular swatfest on both sides. However the game was very interesting from first to last, as both teams were running neck and neck every inning up to the seventh, when the Ermsco's took a lead of 5 runs. In the first of the ninth inning the Electric Appliance Co. made a rally of four runs and brought their score up to 10 runs, ending the game by the score of 10 to 13 in the Ermsco's favor. Tommy Morgan, the Appliance manager, played a very spectacular part in the game the last few innings, by knocking out a couple of two-baggers and then stealing home and instead of sliding for a close finish he turned a flip-flop over the catcher, and scored another run, which nearly saved the day for his team. A home run was made by both teams.

Following is the line-up of the two teams:

Elect. Ry. & Mfg. Sup. Co.		Electric Appliance Co.	
W. Markle	Pitcher	Randall	Left Field
G. Winton	Center Field	Jack	Short Stop
*G. Ross	Center Field	†Morgan	Short Stop
J. Stewart	Catcher	Kinnear	Third Base
T. Finley	Third Base	Barney	Pitcher
R. Rogers	First Base	Longfellow	Right Field
H. Herning	Left Field	Gutfield	Catcher
H. Bigielow	Short Stop	Victor	Second Base
E. Lang	Second Base	Charley	First Base
R. Kahn	Right Field	Ernest	Center Field
		‡Mendelson	Center Field
		§Lorenzo	Center Field

*Took Winton's place in the first of 8th inning.

H. P. Royer, Manager.

†Morgan Sub. for Jack
‡Mendelson Sub. for Ernest.
§Lorenzo Sub. for Mendelson.
"Thommy" Morgan, Mngr.

Western Electric Co. vs. General Electric Co.

The Western Electric Company's baseball team defeated the General Electric team by a score of 2 to 1 in one of the most interesting games ever witnessed. The game went 8 innings without a score, the General scoring one run in the first half of the ninth inning and the Westerns scored two runs in their second half.

It was a well played game, hits being few and far between. Pitcher Steffens of the Western had the better of the duel, alowing only five hits, walking one and fanning nine. Nattinger of the Generals pitched a very good game, but weakened in the ninth, walking two and hitting two; he allowed six hits and fanned seven.

Western Electric Co		General Electric Co.	
Bradford	Center Field	R. Nattinger	Short Stop
Lorgon	Second Base	F. Toomey	Second, Right Field
Daly	Short Stop	M. Jolimay	Catcher
Alexander	Third Base	G. Jolimay	Third Base
Welch	Right Field	F. Flood	Second, Right Field
O'Connell	Left Field	L. Cook	First Base
Howard	First Base	F. Rea	Left Field
Cassidy	Catcher	W. Nattinger	Pitcher
Steffens	Pitcher	C. Cook	Center Field

P. A Strong, Manager. F. Rea, Manager.

Pacific States Elec. Co. vs. Westinghouse Elec. & Mfg. Co.

This game was officially started when D. E. Harris of the Pacific States pitched the first ball over the plate. The game was a good one; full of exciting plays which allowed both pitchers to show the "stuff" they could put on the ball, as well as to give the fielders a chance to pull over a grandstand play once in a while. The Pacific States boys were very proud of their new uniforms, and the report is out that that is the reason they won the game from Westinghouse by a score of 9 to 7; but according to that dope, when the other teams get their uniforms there sure will be "some ball playing."

Dunbar of the Westinghouse pitched a very good game considering the fact that he says he has not played ball for five years, and he deserves credit for the team he has gotten together, for both teams played a good game.

Following is a lineup of the two teams:

Pacific States Elect Co.		Westinghouse Elec. & Mfg. Co.	
Dunning	Short Stop	Milburn	Second Base
McChesney	Left Field	Anderson	First Base
Kennedy	Second Base	Goldman	Short Stop
Markowitz	Third Base	Bagley	Third Base
O'Connell	Pitcher	Goldbeck	Catcher
Kahn	First Base	Dunbar	Pitcher
Lane	Catcher	Ward	Left Field
Kaiser	Right Field	Hagen	Center Field
Maloney	Center Field	Chapman	Right Field
R. J. Wolf	Manager	Merrill	Right Field
		W R. Dunbar	Manager

TRADE NOTES.

T. J. Hopkins has just opened up new offices in the Monadnock building, San Francisco, representing the Central Electric Company of Chicago on this Coast.

F. E. Newberry of San Francisco has secured the big contract for wiring the new building of the American Can Company on Twenty-second and Kentucky streets.

Ne Page & McKenny have secured the contract for the wiring and necessary equipment for the University of California library, Berkeley, amounting to approximately $25,000.

H. S. Tittle, electrical contractor of San Francisco, is at Fort Huachuaco to be there for the final test on the new power station that his firm contracted for some time ago. The cost of the entire job was approximately $75,000.

The Electric Construction Company of San Francisco has a wiring equipment contract from the Miller Estate Company, 300 North Fifteenth street, with 300 outlets and 100 switches. Also another contract at Eighth and Washington streets, 52 outlets and 8 switches, and 331 Walnut street, installing 10 fixtures.

The Pacific Coast Fire Extinguisher Company of San Francisco has recently closed a contract for the electrical installation on the new addition to the Ford Motor Car Company's building at Nineteenth and Harrison streets, as well as being the lowest bidder for the work for the recently renovated Lane Hospital.

UTAH-NEVADA AGRICULTURAL DEMONSTRATION TRAIN.

The agricultural colleges of Utah and Nevada, during the past month, have sent a demonstration train over the lines of the Salt Lake Route. This train consisted of ten cars electrically lighted, equipped and operated. The General Electric Co. exhibited a car fitted with generators, motors, ranges, heaters, washing machines and other electricaly operated devices for the home and ranch. Fairbanks, Morse Company showed a line of electric and gas driven pumps and electric generators and motors. Others cars were equipped by agricultural implement companies. A beet sugar company and the government wool bureau also had cars. All meetings were largely attended and the demonstration is considered a success.

DISCUSSION ON INDUCTIVE INTERFERENCE ORDER.

(Continued from page 341.)

private line of ours a few things came to my attention, and I want to ask of the telephone men if it is not possible that some such procedure could be followed in the case of their toll lines. Have you made investigations for the elimination of inductive influence by means other than transposition? Have you experienced with devices that at the expense of increasing the attenuation of the talking voice you can practically obliterate at least the lower harmonics induced on your lines? Having done so can you not by means that are readily within your command, and that you are now using, amplify again the weakened or attenuated voice currents and bring them out with the absence of the previously disturbing harmonics? I want to ask you if you have followed some such procedure? It is exactly the method and the only method I have found available that made our own private line at all usable. By means of various complex combinations of shunts, I have succeeded in obliterating the fundamental, third, fifth and seventh and the ninth harmonics, although with the ninth and higher we are getting right near the range of maximum audibility and reduce by attenuation the talking voice. However, following the same course, can that be done? Is it possible? And again, is it possible that some device may be put on the line that will produce much greater attenuation with the lower induced frequencies than with the average voice frequencies in the region around eight hundred cycles per second? If that be possible, why not practically eliminate all the lower disturbing frequencies and then with your audion bulbs or other means of amplification bring out again the desired voice currents to any strength desired. My firm conviction is that this can be done and without excessive distortion of the voice currents. My own feeble attempts seem to show that it can be accomplished. But, what are you going to do with the eleventh, thirteenth and fifteenth harmonics? They come right at the point of maximum sensitiveness of the telephone receiver. I don't know. You might get into difficulties there. In my own investigations I did not find any such harmonics that were troublesome. I noticed that in the report of the investigating committee there were a number of these higher frequencies in some of the lines in California, even up to the thirty-seventh harmonic.

I notice, however, that the devices I have used will improve the natural talking voice. I have a Swede operator on the evening shift at the power house and he talks English in the usual manner of the Swede, and my device improves his natural speaking voice and he expresses himself much better and his voice sounds quite like an American by suppressing some of the lower frequencies. It really improves my conversation with him. As a matter of fact, I can understand him better now over our telephone line by suppressing those lower frequencies than I could if I had him in my office and talked to him face to face.

Now gentlemen, you can see from this, that I really know very little about telephony, but I do want to know and these things come up in the powermen's experience and we are all interested in these problems and in the possible solution of them; we want to know more about them, and if you telephone men would come to these meetings and tell us these things and talk over with us our mutual needs, we are going to get along together better and do better work for ourselves.

A. H. Griswold: In regard to Mr. Fisken's suggestion that "Inductive Interference" be studied by a national organization, I understand that such a procedure is already under way. Recently Paul Downing of the Pacific Gas & Electric Company, and H. A. Barre of the Pacific Light & Power Company were in the East, and while there interviewed Dr. Rosa of the Bureau of Standards. It was reported that Dr. Rosa expressed considerable enthusiasm with reference to a nation wide investigation of "inductive interference" by his department, and that it was generally agreed that an appropriation of at least $100,000 by Congress, or otherwise, was necessary in order to start the work.

It is not our intention in presenting tonight, the subject of inductive interference, to, in any way, bring in question the California rules, or to propose them for Oregon. We are simply endeavoring to tell you some of the things we have learned about inductive interference, so that we may meet each other face to face with our problems, and work them out together.

The nature of inductive interference is such that it is extremely difficult to establish specific working rules applying to all cases. It is therefore necessary to establish the fundamentals, and then from these fundamentals work out the solution for each particular case. For example, Mr. Nims asked for a definition of a parallel—that is very much like trying to answer the question, "How long is a piece of string?" I have known parallels of a few spans in length to create more trouble in telephone lines than Mr. Fisken's parallel of ninety miles or more from Spokane to Wallace.

So, it is necessary to carefully determine the particular characteristics and pertinent factors of each parallel, and with these data at hand to determine the best solution for that particular case.

Another question raised by Mr. Nims was with reference to what he considered extreme measures required in connection with parallel power lines and farmer telephone lines. In reply I would call to Mr. Nims' attention the fact that the California order covers only long distance or toll telephone line, and therefore no remedial measures are provided for farmer lines. The case of Mr. Merwin is perhaps one of the most unique in the country. I doubt if you will find many places where the telephone line will be in the vicinity of such a power line. At least, there will be very few instances where the serious difficulties that were involved in that case, will arise. I wish to say further, and to admit very frankly, right now, that I doubt very much whether any telephone man, or the joint committee, would undertake to operate a commercial telephone line under such conditions, particularly if the telephone line and power line were in sufficient proximity to create harmful inductive interference, and the difficulties arising in connection with it so difficult to overcome from the inductive interference standpoint. I think, Mr. Merwin, we would be inclined to move across the river.

The question of devices to prevent or mitigate inductive interference was raised by some one. In answer I think we have investigated every device ever propounded on an unsuspecting public, and in addition we have done every reasonable thing known to art, to eliminate interference, before taking the matter up with the power companies. But it is almost inevitably found that the best, the most economical, and the most reasonable solution does not lie with the telephone lines alone, but rather by effecting certain changes with reference to both the telephone and power lines.

Mr. Fisken stated that recently the telephone protecting devices had been found satisfactory for 7500 volts, instead of 500 volts. If that is true, we are happier than the power men; but, to date, the data which I have had has been the result of thousands of experiments on these protecting devices which have placed the safety limit at 5000 volts.

In closing I wish to state that while the solutions of inductive interference troubles have in the past, and may sometimes in the future, seem rather difficult, I know from past experience that if we will together look at each problem fairly and squarely with reference to the facts as they are, we will both be surprised and gratified at the comparative ease with which proper and efficient remedial measures can be obtained. All that we ask is that you meet us half way, tell us your troubles, just as we shall tell you our own, and from such a better mutual understanding only good to both of us and to the community at large, can result.

NEWS NOTES

INCORPORATIONS.

MAGDALENA, N. M.—The K. W. Light & Power Company of Magdalena has filed articles with the state corporation commission, with an authorized capital of $50,000. The principal incorporators are George Keith of Magdalena and J. E. Wayne of Socorro and H. H. Lisle of Elmendorf.

MONTICELLO, N. M.—The Socorro-Sierra Telephone Company has been formed by W. G. Milligan and Joe Milligan of San Marcial, N. M., and Antonio T. Chavez and Edward Milligan of Monticello, N. M. The principal place of business is at Monticello.

RIALTO, CAL.—With a capitalization of $350,000, the Fontana Power Company has been incorporated by A. B. Miller, J. C. Jones, R. H. Hassler, C. A. Stone and A. Wilson. The company expects to absorb the present Fontana water supply system. Power will be developed in the San Bernardino mountains and supply other localities about Fontana.

LOS ANGELES, CAL.—The Southern California Telephone Company has filed articles of incorporation with a capital stock of $10,000,000. The purpose is to merge the Pacific Telephone & Telegraph Company and the Home Telephone Company in Southern California. The incorporators are J. G. Mott, R. J. Dillon, G. C. O'Connell, V. F. Collins, A. L. Rowland, C. H. Merrill and Arthur N. Gage.

ILLUMINATION.

NEWPORT BEACH, CAL.—This city has voted $30,000 in bonds for the municipal distribution of natural gas.

LA CRESSE, WASH.—H. G. Wilson has received an electric lighting franchise and has begun the erection of his plant on Crystal street.

LOS ANGELES, CAL.—The board of supervisors has granted the request for the installation of additional lights in the Hawthorne Lighting District.

BERKELEY, CAL.—Several property owners have asked the council to form a lighting district east of Shattuck avenue and north of the University Campus.

LAKEPORT, CAL.—F. L. Wright, general manager of the California Telephone & Light Company, has been looking over the Lake County plant, making estimates of the cost of its reconstruction.

ROSEBURG, ORE.—An election will be held May 1st for the purpose of voting on the granting of an electric franchise to A. E. Brais. Mr. Brais proposes to establish electric light and power service in Riddle.

CASA GRANDE, ARIZ.—Plans for the proposed municipal light, power, ice and water works here, for the building of which $30,000 bonds have been voted, have been prepared by City Engineer Sidney K. Mashbir.

RENO, NEV.—Incandescent street lights of 400 candlepower are to be installed in the residence section of Reno. The city council has authorized the Reno Power, Light & Water Company to proceed with the work.

SANTA ANA, CAL.—Plans for better street lighting include negotiations for replacing the incandescents now in use by new nitrogen lamps and for other changes. It is believed that at least four additional arc lights should be put in and that the lighting of outlying streets should be extended.

TRANSMISSION.

LOVELOCK, NEV.—The Nevada Valleys Power Company is considering the extension of its high tension transmission power line northward from Lovelock.

SPOKANE, WASH.—Negotiations are under way for the purchase of the electric plant of the Similkameen Power Company by Eugene Enloe of Spokane, representing the Okanogan Valley Power Company.

MONTESANO, WASH.—The purchase of the Elma Light & Power Company by the Northwest Electric & Water Works of Montesano, has been announced and the electric service of Montesano and Elma will be combined.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has purchased the municipal lighting plants at Wellsville and at Farmington, Utah and is now serving these towns under contract. The operation of both plants has been unprofitable to the municipalities.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has applied to the commissioners of Yakima county for a 50 year franchise to construct and operate electric power lines for electric light, telephone and telegraph purposes along the county roads. A hearing will be held May 1st.

LOS CRUCES, N. M.—The board of directors of the Water Users' Association has investigated the Leasburg hydroelectric power proposition and estimates have been prepared by engineers. The cost of construction, installation of machinery and a power line to Los Cruces will be approximately $60,000.

BAKER, ORE.—The city council of Richland, Baker county, has granted a 20 year franchise to the Dry Gulch Ditch Company to construct and maintain an electric lighting system. The company will develop power from Eagle River and it is announced will be ready to serve Richmond and a portion of Eagle valley by the first of October.

LOS ANGELES, CAL.—A resolution has been adopted by the city council declaring that it is necessary for municipal purposes, and that public necessity requires that a permanent easement and right-of-way be acquired for the purpose of constructing electric power transmission lines and telephone lines extending from a point in Inyo county to a point in Los Angeles county.

SAN FRANCISCO, CAL.—The Great Western Power Company and the Pacific Gas & Electric Company have arranged for the joint use of poles on Clement street from Arguello boulevard to Twenty-fifth avenue. The Great Western Company is to erect poles 60 ft. high, large enough to carry the wires of several companies, and will transfer to them the wires of the Pacific Gas & Electric Company, which will then remove its small poles.

TELEPHONE AND TELEGRAPH.

VALLEJO, CAL.—A 25 year franchise has been granted the Pacific Telephone & Telegraph Company. The city is to receive 2 per cent of the company's gross receipts from business.

PASCO, WASH.—David C. Jeff, D. W. Jeff and W. O. Rogers have made application to the commissioners of Franklin county for permission to maintain a telephone system over the Pasco and Rattlesnake roads.

OXNARD, CAL.—At a meeting of the board of trade the proposed consolidation of the two telephone companies here were discussed. C. J. Elliott, R. B. Whitman and Ed. Abplanalp were appointed as a committee to meet the local managers of the companies.

MANSFIELD, WASH.—Al. Rogers has presented a proposition to the business men whereby the Farmers' Independent Telephone Company will give a 24 hour service and a direct toll line to the county seat. If sufficient business can be secured, the line will be built.